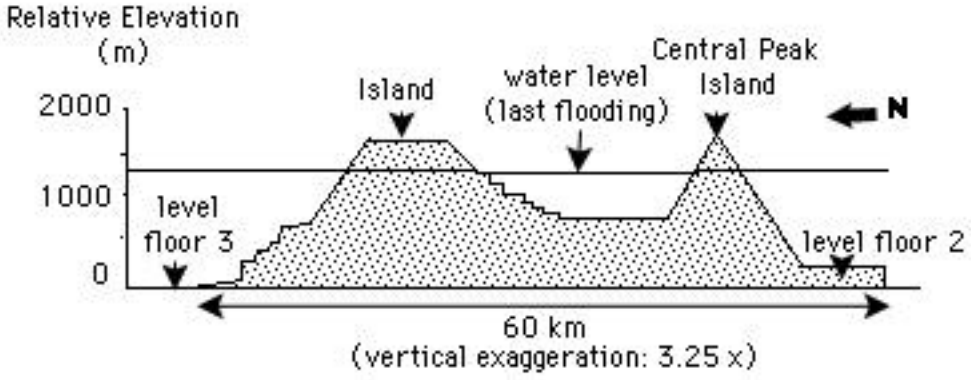
EARLY AMAZONIAN LAKE IN GALE CRATER (MARS), N.A. Cabrol, NASA Ames Research Center, Space Science Division, MS 245-3, Moffett Field, CA 94035-1000.

Gale is a 140 km diameter impact crater located in the Aeolis Northwest subquadrangle of Mars (-5^0 Lat./223^0 long.). The crater is bordered northward by the Elysium Basin, by hesperian channels and by the Aeolis Mensae eastward [1,2]. Gale crater shows the most compelling evidence of past lacustrine activity.
Description: The crater displays a rim with two distinct erosion stages: though eroded, the south rim of Gale still has an apparent crest line visible from the north to the southwest; The west and northwest rims are characterized by a strong erosion that in some places partially destroyed the rampart, leaving remnant pits embayed in a smooth-like deposit. The same type of deposit is observed north, outside to Gale, borders Aeolis Mensae, covers the bottom of the plateau scarp, and the crater floor. The central part of Gale crater shows a 6400 km^2 subround and asymmetrical deposit: a) a south sector composed of a smooth material; b) a north sector showing spectacular terracing, streamlining, and channelization. The transition between the two sectors of the deposit is characterized by a scarp ranging from 200 m to 2000 m high. The highest point of the scarp is at the center of the crater and probably corresponds to a central peak. Conversely to Gusev crater and Ma'adim Vallis in the Aeolis Northeast region [3], Gale crater does not show a major channel directly inflowing. However, several large fluvial systems are bordering the crater and could be at the origin of the flooding(s) (or have contributed to). Only one minor system is entering its southwest rim and cannot be accounted alone for the volume of sediment deposited in Gale crater. The channel erodes the crater floor deposits and ends in an irregular-shaped and dark albedo feature. The same albedo is observed at the foot of the deposits west and northeast in the crater. Comparable albedo units are observed in Gusev crater also. *Origin, distribution, and age of sediments:* Gale shows the morphology of a crater formerly filled during sedimentation episodes, and then exhumed. Thus, part of the lower sediment deposition contained in Gale may be ancient and not only aqueous in origin. According to the regional geologic history, the sedimentary deposit could be a mixture of: aeolian and pyroclastic material [1], and aqueous sedimentary material that can originate both from drainage of the regional subsurface aquifer, and from surface flooding. The deposit shows 3 main levels: a) the current crater floor (north sector); b) an ancient level about 200 m higher (south sector); c) the massive terraced deposit. A crater statistics on the 15 400 km^2 area of the crater floor and deposit gives 390+/-159, most of them partly embayed in sediment, and all inferior to 5 km diameter. The populations of crater are comparable for the three levels and give an Early Amazonian age.*Hydrologic and Lacustrine Significance:* the streamlined morphology of the border of the deposits and the terraces are compatible with a shoreline associated with a lacustrine activity in Gale crater. Various levels may suggest different episodes, but the common statistical age of the 3 levels indicate that the last event involved the whole crater. The last flooding should have been important enough to flood the central deposit up to about 1400 m above the crater floor, leaving 2 islands (non-streamlined features) at the center of the deposit (*see* figure below, and map). The direction of erosion of the crater rampart supports the hypothesis of one, or a series, of surface flooding(s). This flooding(s) may have come through time from : the eastern channels, from the flood plain of these channels northward, that overtopped the ramparts. However, considering the age of the crater floor, we suggest that a last flooding event related to the activation of the Elysium Basin is more likely.



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Terrace spacing suggests a regular drop of the lake level in time. Fractures in terraces perpendicular to the shoreline can be interpreted both as: a) the result of the drainage systems when the level of the lake went down; b) traces of the pressure of an ice-covered sheet associated with subglacial drainage.
Conclusion: The presence of a lake of such volume during the Amazonian period is one more evidence that water was still active on Mars recently. This lake, located 2500 km west from Gusev crater lake that was active during the same geological period [3,4,5] reinforces the model of an extensive water activity during the Amazonian as opposed to local and random events.

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References: [1] Scott *et al.* (1995) USGS map I-2461; [2] Greeley and Guest (1987) USGS map I-1802-B; [3] Cabrol *et al.* 1996, *Icarus 123*, 269-283; [4] Grin and Cabrol (submitted to Icarus); [5] Kuzmin *et al.*, (in progress).